IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of

Edward A. Wells

Serial Number 09/630,255

Filed: August 1, 2000

For: PLUNGER LIFT METHOD AND APPARATUS

Art Unit 3672

Examiner Jennifer Dougherty

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231, on 5/30/02

G. Turner Moller
Reg. No. 22,978

5/30/02 (Date) (Signature)

Declaration

Assistant Commissioner for Patents
Washington, D. C. 20231

Dear Sir:

1. The undersigned is the inventor in this application.

2. I have equipped about one hundred five wells with plunger lifts of this invention, i.e. comprising a ball and a sleeve. These wells are equipped with a bumper spring near the formation to absorb the force of the ball and sleeve as they reach the bottom of the well. Because these wells produce a significant amount of liquid and the plunger lifts are used to lift this liquid to the surface, there is often a quantity of liquid at the bottom of the well that slows down the ball and sleeve as they approach the bumper spring. There is no doubt in my mind that there are

occasions where the ball and sleeve, or the ball and bumper spring, collide with substantial force. It is difficult to believe that the sleeve contacts the bumper spring directly because the ball protrudes substantially below the bottom of the sleeve.

3. The attached photographs show two sleeves that were removed from wells. The ends of these sleeves have been broken while operating in a well. In my judgement, these sleeves were broken during a collision with the ball at the bottom of a well because the ball was slightly off center when the sleeve arrived at the bumper spring. The ball occasionally shows significant wear. I have in my possession a ball that is significantly out of round due to repeated impacts with the bumper spring and/or the sleeve. This particular ball started out as a more or less perfect sphere having a 1.375 inch diameter. It is now oval and has a major diameter of 1.30 inches and a minor diameter of 1.204 inches.

4. In my judgment, two part plunger lifts using resilient seals in general, and O-rings in particular, are not likely to have long enough lives to be practical when used to lift liquids from gas wells, i.e. from wells where the tubing string is largely filled with gas allowing the ball and sleeve to reach high velocities when falling into the well. My belief is based on the following analysis.

I have never instrumented a well in order to measure the time for a sleeve and ball to fall to the bottom of a well. But, I can make a reasonable estimate based on the following facts. The fastest cycle time, i.e. the time for the sleeve and ball to fall into a well and then return to the surface, in a typical 6000' gas well is about six minutes. I know the time to fall to the bottom of the well is much shorter than the time for the plunger lift to rise back to the surface. In a rough way, this is easy to appreciate because the sleeve produces a slight ping as it passes every joint of tubing in the well. As the sleeve is falling into the well, the pings are very close together. When the sleeve is rising in the well, the pings are much farther apart.

Thus, in my judgment, it doesn't take more than a minute or two for the ball and sleeve to fall into a well which is mostly gas and a little liquid, meaning that the terminal velocity of the slower component, which is the sleeve, is at least 50-100 feet/-second (6000' divided by 1 minute = 100 feet per second average or 6000' divided by 2 minutes = 50 feet per second average - meaning that the terminal velocity is somewhat higher). I believe this is reasonable because it is the same order of magnitude of other bodies falling freely in a gas.

One will appreciate that the force acting on the ball and on the sleeve is proportional to its mass times the square of its

velocity. An object which must withstand repeated impacts at velocities of 50-100 feet/second must be made of rugged materials and be of a design to withstand these impacts. After all, 50-100 feet per second is 34-68 miles per hour. No rubber component can long tolerate the forces generated by impacts at these speeds.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Date: 5/28/02

Edward A. Wells